Q1 a)

		1% Ca	30% Protein	5% Fiber	
90	Corn	0.001	0.09	0.02	$0.2
	Soybean	0.002	0.6	0.06	$0.6

Dec Var:

Let X_1 : # of corns in pounds

X_2 : # of soybean in pounds

Obj : Min $0.2X_1 + 0.6X_2$

Constraints : $0.001X_1 + 0.002X_2 \leq 0.9$

s.t $0.09X_1 + 0.06X_2 \geq 27$

$0.02X_1 + 0.06X_2 \leq 4.5$

$X_1 + X_2 = 90$

$X_1, X_2 \geq 0$

b) Optimal sol:

Q2 a)

Month	1	2	3	4	5
# of Labors	110	130	70	165	50
Cost / laboror	110	140	170	230	250

Dec Var:

X_{ij} : # of people hired at the beginning of month i for j months

$X_{11}, X_{12}, X_{13}, X_{14}, X_{15}$

$X_{21}, X_{22}, X_{23}, X_{24}$

X_{31}, X_{32} X_{33}

X_{41}, X_{42}

X_{51}

obj min $110X_{11} + 140X_{12} + 170X_{13} + 230X_{14} + 250X_{15} + 110X_{21} + 140X_{22} + 170X_{23} + 230X_{24} + 110X_{31} + 140X_{32} + 170X_{33} + 110X_{41} + 140X_{42} + 110X_{51}$

Constraints :

s.t

$X_{11} + X_{12} + X_{13} + X_{14} + X_{15} \geq 110$

$X_{21} + X_{22} + X_{23} + X_{24} \geq 130$

$X_{31} + X_{32} + X_{33} \geq 70$

$X_{41} + X_{42} \geq 165$

$X_{51} \geq 50$

$X_{ij} \geq 0$

b) Optimal Sol.

Q3 Max $10X_1 + 20X_2$

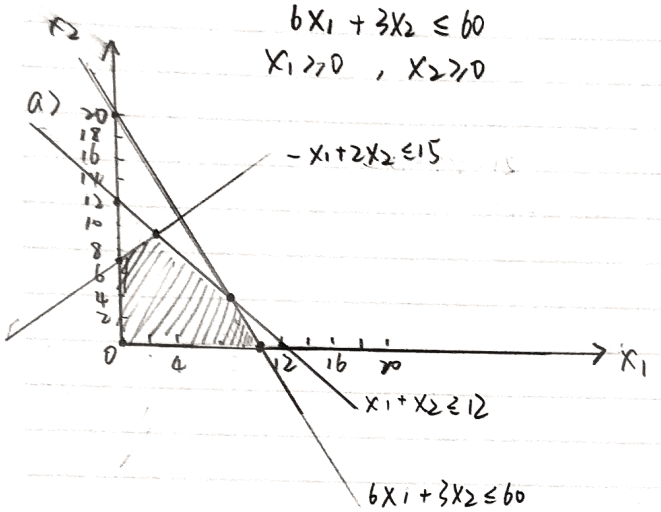
s.t $-X_1 + 2X_2 \le 15$

$X_1 + X_2 \le 12$

$6X_1 + 3X_2 \le 60$

$X_1 \ge 0, \quad X_2 \ge 0$

a)



b) Optimal Sol.

$$\begin{cases} -X_1 + 2X_2 = 15 & ① \\ X_1 + X_2 = 12 & ② \end{cases}$$

① + ②: $3X_2 = 27$

$X_2 = 9$

$\therefore \begin{cases} X_1 = 3 \\ X_2 = 9 \end{cases}$

$\Rightarrow 10X_1 + 20X_2 = 210$

$\therefore$ Optimal sol is $\boxed{(3, 9)}$ with objective value of $\boxed{210}$.

Q4 a)

	C1	C2	C3	Output
F1	$600	800	700	400
F2	400	900	600	500
Size	300	200	400	

Dec Variables:

let X_{ij} : # of units shipped from factory i to customer j

$i = 1, 2 \quad j = 1, 2, 3$

$X_{11}, X_{12}, X_{13}, X_{21}, X_{22}, X_{23}$

Objectives: min $600X_{11} + 800X_{12} + 700X_{13} + 400X_{21} + 900X_{22} + 600X_{23}$

Constraints

st $x_{11} + x_{12} + x_{13} \leq 400$

$x_{21} + x_{22} + x_{23} \leq 500$

$x_{11} + x_{21} \geq 300$

$x_{12} + x_{22} \geq 200$

$x_{13} + x_{23} \geq 400$

$x_{ij} \geq 0$

b) Optimal Sol: